

CLAIMS

1. A vehicle air-conditioning apparatus, comprising:
a heat releasing device having a refrigerant heat releasing passage through which supercritical refrigerant passes to exchange heat with refrigerant cooling air introduced from an air introduction surface of the heat releasing device to be cooled; and

an evaporator by which the cooled refrigerant exchanges heat with air to be introduced in a passenger compartment,

wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to the air introduction surface of the heat releasing device as ventilation loss utilizing air, so that the ventilation loss utilizing air is used as a part of the refrigerant cooling air, and

wherein the ventilation loss utilizing air is introduced to a downstream side area of the refrigerant heat releasing passage on the air introduction surface of the heat releasing device.

2. The vehicle air-conditioning apparatus as recited in claim 1, wherein an occupancy area ratio of an area to which the ventilation loss utilizing air is introduced with respect to the air introduction surface of the heat releasing device is set to 2 to 20%.

3. The vehicle air-conditioning apparatus as recited in claim 1, wherein the ventilation loss utilizing air is introduced

to an area including a downstream side end portion of the refrigerant heat releasing passage on the air introduction surface.

4. A vehicle air-conditioning apparatus, comprising:
first and second heat releasing devices each having a refrigerant heat releasing passage, wherein supercritical refrigerant passes through the first and second heat releasing devices in this order to exchange heat with refrigerant cooling air introduced from each air introduction surface of the first and second heat releasing devices to be cooled; and
an evaporator by which the refrigerant cooled by the second heat releasing device among the first and second heat releasing devices arranged at a refrigerant downstream side exchanges heat with air to be introduced into a passenger compartment,
wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to the air introduction surface of the second heat releasing device as ventilation loss utilizing air, so that the ventilation loss utilizing air is used as a part of the refrigerant cooling air.

5. The vehicle air-conditioning apparatus as recited in claim 4, wherein an occupancy area ratio of the air introduction surface of the second heat releasing device with respect to a total area of the air introduction surfaces of the first and second heat releasing devices is set to 2 to 20%.

6. The vehicle air-conditioning apparatus as recited in

claim 4 or 5, wherein the first heat releasing device and the second heat releasing device are arranged apart from each other.

7. The vehicle air-conditioning apparatus as recited in any one of claims 4 to 6, wherein one of the first heat releasing device and the second heat releasing device is arranged at a vehicle front portion, and the other heat releasing device is arranged at a vehicle rear portion.

8. A vehicle air-conditioning apparatus, comprising:
a plurality of heat releasing devices each having a refrigerant heat releasing passage, wherein supercritical refrigerant passes through the plurality of heat releasing devices in order to exchange heat with refrigerant cooling air introduced from each air introduction surface of the plurality of heat releasing devices to be cooled; and

an evaporator by which the refrigerant cooled by a final staged heat releasing device among the plurality of heat releasing devices arranged at a refrigerant downstream side exchanges heat with air to be introduced into a passenger compartment,

wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to an air introduction surface of the final staged heat releasing device as ventilation loss utilizing air, so that the ventilation loss utilizing air is used as a part of the refrigerant cooling air.

9. The vehicle air-conditioning apparatus as recited in

claim 8, wherein an occupancy area ratio of the air introduction surface of the final staged heat releasing device with respect to the total area of the air introduction surfaces of the plurality of heat releasing devices is set to 2 to 20%.

10. A vehicle air-conditioning apparatus, comprising:
first and second heat releasing devices each having a refrigerant heat releasing passage, wherein supercritical refrigerant passes through the first and second heat releasing devices in this order to exchange heat with refrigerant cooling air introduced from each air introduction surface of the first and second heat releasing devices to be cooled; and

an evaporator by which the refrigerant cooled by the second heat releasing device among the first and second heat releasing devices arranged at a refrigerant downstream side exchanges heat with air to be introduced into a passenger compartment,

wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to the air introduction surface of the second heat releasing device as ventilation loss utilizing air, so that the ventilation loss utilizing air is used as a part of the refrigerant cooling air, and

wherein the ventilation loss utilizing air is introduced to a downstream side area of the refrigerant heat releasing passage on the air introduction surface of the second heat releasing device.

11. A vehicle air-conditioning apparatus, comprising:

a plurality of heat releasing devices each having a refrigerant heat releasing passage, wherein supercritical refrigerant passes through the plurality of heat releasing devices in order to exchange heat with refrigerant cooling air introduced from each air introduction surface of the plurality of heat releasing devices to be cooled; and

an evaporator by which the refrigerant cooled by a final staged heat releasing device among the plurality of heat releasing devices arranged at a refrigerant downstream side exchanges heat with air to be introduced in a passenger compartment,

wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to the air introduction surface of the final staged heat releasing device as ventilation loss utilizing air, so that the ventilation loss utilizing air is used as a part of the refrigerant cooling air, and

wherein the ventilation loss utilizing air is introduced to a downstream side area of the refrigerant heat releasing passage on the air introduction surface of the final staged heat releasing device.

12. The vehicle air-conditioning apparatus as recited in any one of claims 1 to 11, wherein CO₂ refrigerant is used as the supercritical refrigerant.

13. A vehicle air-conditioning heat releasing device, comprising:

a refrigerant heat releasing passage through which supercritical refrigerant passes; and

an air introduction surface for introducing refrigerant cooling air,

wherein the supercritical refrigerant passing through the refrigerant heat releasing passage exchanges heat with the refrigerant cooling air introduced from the air introduction surface,

wherein at least a part of discharge air discharged from an inside of a passenger compartment is introduced to the air introduction surface as ventilation loss utilizing air, so that the ventilation loss utilizing air is used as a part of the refrigerant cooling air, and

wherein a discharge air introduction area for introducing the ventilation loss utilizing air is provided at a downstream side area of the refrigerant heat releasing passage on the air introduction surface of the heat releasing device.

14. The vehicle air-conditioning heat releasing device as recited in claim 13, wherein an occupancy area ratio of the discharge air introduction area with respect to the total area is set to 2 to 20%.

15. The vehicle air-conditioning heat releasing device as recited in claim 13 or 14, wherein the discharge air introduction area is provided at an area including a downstream side end portion of the refrigerant heat releasing passage on the air introduction surface.

16. The vehicle air-conditioning heat releasing device as recited in any one of claims 13 to 15, wherein CO₂ refrigerant is used as the supercritical refrigerant.

17. A vehicle air-conditioning method in which supercritical refrigerant passing through a heat releasing passage of a heat releasing device exchanges heat with refrigerant cooling air introduced to an air introduction surface of the heat releasing device to be cooled, and the cooled refrigerant exchanges heat with air to be introduced into a passenger compartment by an evaporator,

wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to an air introduction surface of the heat releasing device as ventilation loss utilizing air so as to utilize the ventilation loss utilizing air as a part of the refrigerant cooling air; and

wherein the ventilation loss utilizing air is introduced to a downstream side area of the refrigerant heat releasing passage on the air introduction surface of the heat releasing device.

18. A vehicle air-conditioning method in which supercritical refrigerant passing through each refrigerant heat releasing passage of first and second heat releasing devices in order exchanges heat with refrigerant cooling air introduced to each air introduction surface of the first and second heat releasing devices to be cooled, and the refrigerant cooled by

the second heat releasing device arranged at a refrigerant downstream side among the first and second heat releasing devices exchanges heat with air to be introduced into a passenger compartment by an evaporator,

wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to the air introduction surface of the second heat releasing device as ventilation loss utilizing air so as to utilize the ventilation loss utilizing air as a part of the refrigerant cooling air.

19. A vehicle air-conditioning method in which supercritical refrigerant passing through each refrigerant heat releasing passage of a plurality of heat releasing devices in order exchanges heat with refrigerant cooling air introduced to each air introduction surface of the plurality of heat releasing devices to be cooled, and the refrigerant cooled by the final staged heat releasing device arranged at a refrigerant downstream side among the a plurality of heat releasing devices exchanges heat with air to be introduced into a passenger compartment by an evaporator,

wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to the air introduction surface of the final staged heat releasing device as ventilation loss utilizing air so as to utilize the ventilation loss utilizing air as a part of the refrigerant cooling air.

20. A vehicle air-conditioning method in which

supercritical refrigerant passing through each refrigerant heat releasing passage of first and second heat releasing devices in order exchanges heat with refrigerant cooling air introduced from each air introduction surface of the first and second heat releasing devices to be cooled, and the refrigerant cooled by the second heat releasing device arranged at a refrigerant downstream side among the first and second heat releasing devices exchanges heat with air to be introduced into a passenger compartment by an evaporator,

wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to the air introduction surface of the second heat releasing device as ventilation loss utilizing air so as to utilize the ventilation loss utilizing air as a part of the refrigerant cooling air, and

wherein the ventilation loss utilizing air is introduced to a downstream side area of the refrigerant heat releasing passage on the air introduction surface of the second heat releasing device.

21. A vehicle air-conditioning method in which supercritical refrigerant passing through each refrigerant heat releasing passage of a plurality of heat releasing devices in order exchanges heat with refrigerant cooling air introduced to each air introduction surface of the plurality of heat releasing devices to be cooled, and the refrigerant cooled by a final staged heat releasing device arranged at a refrigerant downstream side among the a plurality of heat releasing devices

exchanges heat with air to be introduced into a passenger compartment by an evaporator,

wherein at least a part of discharge air discharged from an inside of the passenger compartment is introduced to the air introduction surface of the final staged heat releasing device as ventilation loss utilizing air so as to utilize the ventilation loss utilizing air as a part of the refrigerant cooling air, and

wherein the ventilation loss utilizing air is introduced to a downstream side area of the refrigerant heat releasing passage on the air introduction surface of the final staged heat releasing device.

22. A vehicle air-conditioning method as recited in any one of claims 17 to 21, wherein CO₂ refrigerant is used as the supercritical refrigerant.

23. A vehicle equipped with the vehicle air-conditioning apparatus as recited in any one of claims 1 to 12.